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PATENT**Remarks**Summary of the Office Action

Claims 1-7 were pending.

Claims 1-7 have been rejected under 35 U.S.C. § 102(b) as being anticipated by either Joseph U.S. patent No. 5,503,655 ("Joseph") or Entrekin et al. U.S. patent No. 4,838,340 ("Entrekin"). Claims 1-6 have also similarly rejected as anticipated by either Harker U.S. patent No. 4,932,635 ("Harker I") or Harker et al. U.S. patent No. 4,961,776 ("Harker II"). Further, claims 2-6 have been objected to under 37 C.F.R. 1.75(c) as having improper dependent forms.

Applicants' Reply

Applicants have amended claims 1-7 to clarify the invention and to address the 37 C.F.R §1.75 objections. Applicants also present new dependent claims 8-12 for examination. No new subject matter has been introduced. Applicants respectfully traverse the prior art rejections.

37 C.F.R §1.75 objections.

Applicants have amended claim 1 so that the claimed apparatus can be viewed as having two primary elements, i.e. (1) a cold hearth and (2) a skull wing-inhibiting configuration. Further, claims 2-6 have been amended to recite specific characteristics of the skull wing inhibiting configuration of claim 1. Claims 2-6 for example, recite specific types of electron beam that are provided by the skull wing inhibiting configuration of claim 1. Applicants respectfully submit that amended claims 2-6 properly limit the apparatus of claim 1 and conform to all requirements of 37 C.F.R §1.75.

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Applicants have improved upon prior art cold hearth refining apparatus and processes. Claims 1-6 are directed to the improved cold hearth refining apparatus. Claim 7 and new dependent claims 8-12 are directed to the improved cold hearth refining apparatus method.

Independent claim 1

The improved cold hearth refining apparatus, according to claim 1, includes a cold hearth which holds a pool of molten material, and an electron beam gun and a programmable controller deployed in a "skull wing inhibiting configuration." The skull wing inhibiting configuration, which includes an electron gun, provides an electron beam that sweeps along at least a portion of the perimeter of the pool of molten material to inhibit formation of skull wings at the edges of the pool of molten metal.

The Examiner correctly notes that all of the cited prior art references — Joseph, Entrekin, Harker I and Harker II, all describe cold hearth refining apparatus methods. However, that none of the cited references discloses applicants' improved cold hearth refining apparatus. In particular, the cited references do not disclose teach or suggest the particular "skull wing inhibiting configuration" element recited in claim 1 (i.e., a skull wing inhibiting configuration that "provides an electron beam that sweeps along at least a portion of the perimeter of the pool of molten material to inhibit formation of skull wings at the edges of the pool of molten metal").

For example, Joseph describes a low cost production furnace (FIG. 1) to process titanium slag. Joseph deploys conventional electron beam configurations to heat the surface of the titanium slag to form or reheat molten pools of liquid metal (See e.g.,

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FIG. 1 electron beam guns 24 in chambers 100 and 200, col. 5 lines 36- 42, lines 48-50). Joseph does not show, teach or suggest a skull wing inhibiting configuration that “provides an electron beam that sweeps along at least a portion of the perimeter of the pool of molten material to inhibit formation of skull wings at the edges of the pool of molten metal” as required by claim 1.

Entrekin, describes continuous casting of fine grain ingots. Like Joseph, Entrekin deploys conventional electron beam configurations to heat “a central portion” and “raise the temperature” of the molten liquid metal. (See e.g., FIGS 1 and 2, col. 4 lines 26-52, claim 2, etc.. Like Joseph, Entrekin does not show, teach or suggest a skull wing inhibiting configuration that “provides an electron beam that sweeps along at least a portion of the perimeter of the pool of molten material to inhibit formation of skull wings at the edges of the pool of molten metal” as required by claim 1.

Like Joseph and Entrekin, Harper I and II both describe directed energy input devices 15 designed to form or reheat molten pools of liquid metal. (See e.g., Harper I, FIG. 1, col. 2 lines 47-63: “energy beams 15 directed to desired regions of the hearth to heat material 14 to be melted,” “one of electron beams 16 is concentrated on raw material 14 in a melting region 17 . . . so as to melt that material,” etc.). Like Joseph and Entrekin, Harper I and II do not show electron beams directed to perimeter of a pool of molten material to inhibit formation of skull wings at the edges of the pool.

Thus, the cited references do not show the particular “skull wing inhibiting configuration,” which as recited in claim 1 “provides an electron beam that sweeps along at least a portion of the perimeter of the pool of molten material to inhibit formation of

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skull wings at the edges of the pool of molten metal." Accordingly, claim 1 is patentable over the cited references.

Independent claim 7

Applicants' improved cold hearth refining method involves perimeter cleaning of a pool of molten material. This according to claim 7, requires sweeping a portion of the perimeter of the liquid pool with an electron beam so that volatile impurities that evaporate from the pool of molten material and recondense on the perimeter are dispersed.

As discussed above with references to claim 1, the cited references describe only heating of material (e.g., central portions) to form or reheat pools of molten material. (See e.g., Joseph col. 5 lines 28-51, and Entrekin col. 4 lines 26-36). None of the cited references describes perimeter cleaning using an electron beam. In particular, the cited references do not show "sweeping a portion of the perimeter of the liquid pool with an electron beam so that volatile impurities that evaporate from the pool of molten material and recondense on the perimeter are dispersed." Accordingly, claim 7 is patentable over the cited references.

Dependent claims 2-6 and 8-12

Dependent claims 2-6 and 8-12 are patentable over the cited prior art for at least the same reasons that their respective parent claims 1 and 7 are patentable as discussed above.

Conclusion

Applicants respectfully submit that this application is now in condition for allowance. Reconsideration and prompt allowance of which are requested. If there are

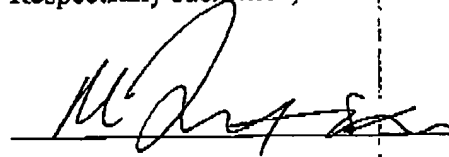
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any remaining issues to be resolved, the applicants request that the Examiner contact the undersigned attorney for a telephone interview.

Respectfully submitted,



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